## **GIFTS: Designing and Making an Olympic Cauldron: A First-Year Mechanical Engineering Design Challenge**

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This GIFTS paper discusses a design challenge in a first-year mechanical engineering course where students design and make a structure in the spirit of the Olympic cauldron [1]. Engaging first-year engineering students in hands-on projects can foster creativity, teamwork, and practical problem-solving skills [2]. This challenge introduces students to the engineering design process, emphasizing brainstorming, design process application, visual thinking, and prototyping.

Students work in teams of 5-6 to fabricate an Olympic cauldron (consisting mostly of cardboard and plastic cups) at the center of a 10' x 10' space without entering the area or touching cups with their hands (needing to make a tool for this). With the Olympic theme, the final structure must be moved to the center of the space and ceremonially "lit." Though cardboard is unlimited, cups are limited to 50, and only a few other materials are allowed: string, wooden dowels, rubber bands, glue sticks, tape, a t-shirt, 2-liter soda bottles, and a "gold medal."

The primary goal for this challenge is to construct the tallest Olympic cauldron within a threeminute limit, considering criteria like speed, stability, strength, ingenuity, elegance, teamwork, and effort. Given the constraints on time, team size, and materials, this design challenge fosters creativity and provides multiple opportunities to discuss aspects of systems engineering [3]. By applying design process knowledge, students engage in a learn-by-doing approach to emphasize a mindful application of design and building practices at the very start of their studies. The learning goals and objectives align with our introductory mechanical engineering course:

- Generate Alternatives: Apply brainstorming techniques to creatively solve the problem.
- Rapid Prototyping: Use available materials for quick prototyping.
- Mindful of Process: Describe and reflect on the design process.
- Visual Thinking: Document ideas and solutions visually in a design notebook.

Over the span of just one week, students are introduced to the sequential steps of the design process and are afforded ample time to refine their designs. The challenge promotes iterative design through a tinkering pedagogical approach [4], which strikes a balance between rigorous engineering analysis and fostering creativity. Throughout the process, students meticulously document their design journeys and engage in reflective exercises to evaluate their thought processes and decision-making strategies [5]. This structured approach underscores the importance of scaffolding design challenges [6] with supplementary information and prompts that stimulate critical thinking among students. By scrutinizing their assumptions and deliberating trade-off considerations, students achieve more robust and comprehensive solutions. Both constructivism [7] and constructionism [8] uphold essential elements of making by emphasizing active learning, hands-on experiences, and the creation of a tangible artifact.

The Olympic cauldron design challenge offers an engaging opportunity for first-year engineering students for collaborative problem-solving. Through hands-on participation, students iterate on their designs, fostering creativity and applying fundamental engineering principles in a practical and enjoyable design scenario. This experience not only enhances their understanding of the design process but also cultivates essential skills crucial for their future engineering careers.

## References

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